

# Comparison of MODIS and SeaWiFS Chlorophyll Products

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## MODIS Chlorophylls:

- Chlor\_MODIS (MOD19: Dennis Clark)
- Chlor\_a\_2 (MOD21: Janet Campbell)
- Chlor\_a\_3 (MOD21: Ken Carder)

## SeaWiFS Chlorophyll:

- OC4.v4 John E. O'Reilly  
(NASA TM 2000-206892, Vol. 11)

# Why so many MODIS chlorophylls? What's the difference?

Originally there were 2 algorithms:

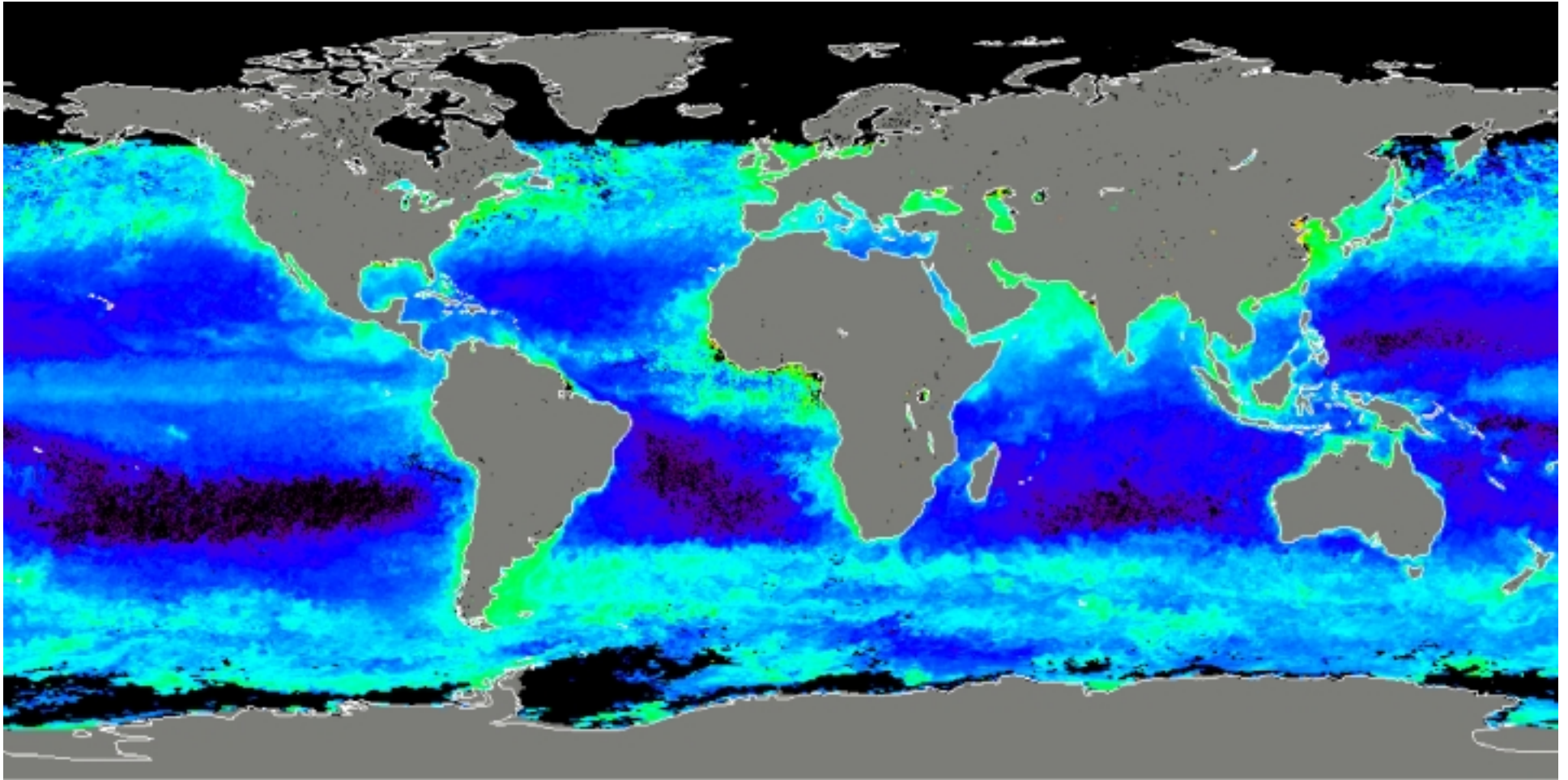
- “Case 1” waters: Chlor\_MODIS (Clark)

This is an empirical algorithm based on the 443:551 band ratio .... following the CZCS approach

- “Case 2” waters: Chlor\_a\_3 (Carder)

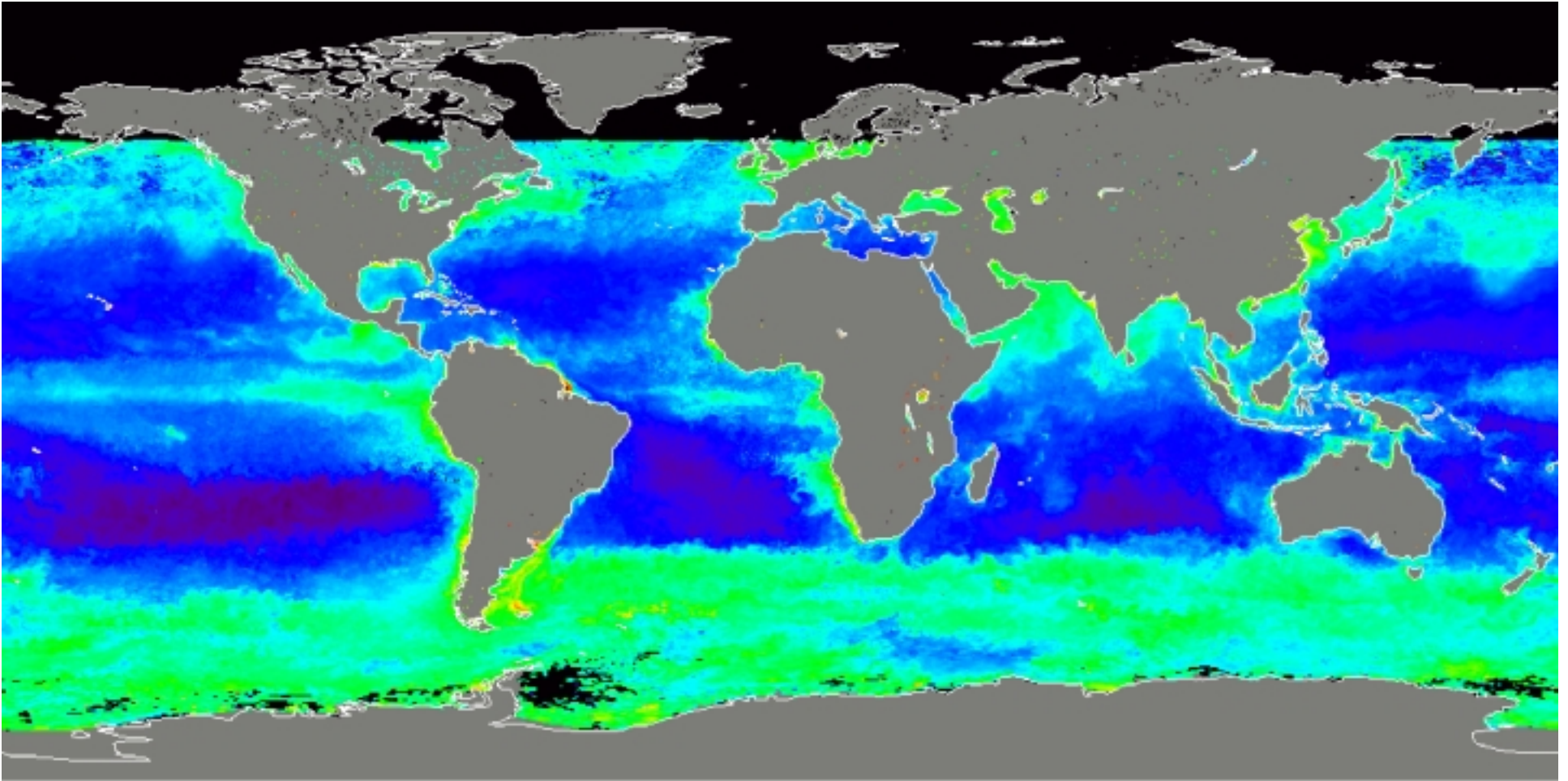
This is a semi-analytic (model-based) inversion algorithm. This approach is required in optically complex “case 2” (coastal) waters.

Chlor\_MODIS December 2000



This algorithm was based on regression involving HPLC chlorophyll(s).  $n=93$ ,  $r^2=0.915$ , std error of estimate = 0.047.

Chlor\_a\_3 December 2000



This “semi-analytic” algorithm accounts for pigment packaging effects in nutrient-replete and nutrient-deplete conditions.

More recently a 3<sup>rd</sup> algorithm was added:

- “SeaWiFS-compatible” Chlor\_a\_2 (Campbell)

This is an empirical algorithm using the 443:551 and 488:551 band ratios whichever is greater.

- SeaWiFS algorithm OC4.v4 (O'Reilly)

This is an empirical algorithm using the 443:555, 490:555 and 510:555 band ratios whichever is greater.

More recently a 3<sup>rd</sup> algorithm was added:

- “SeaWiFS-compatible”      OC3M (O’Reilly & al)  
   ~~Chlor\_a\_2 (Campbell)~~

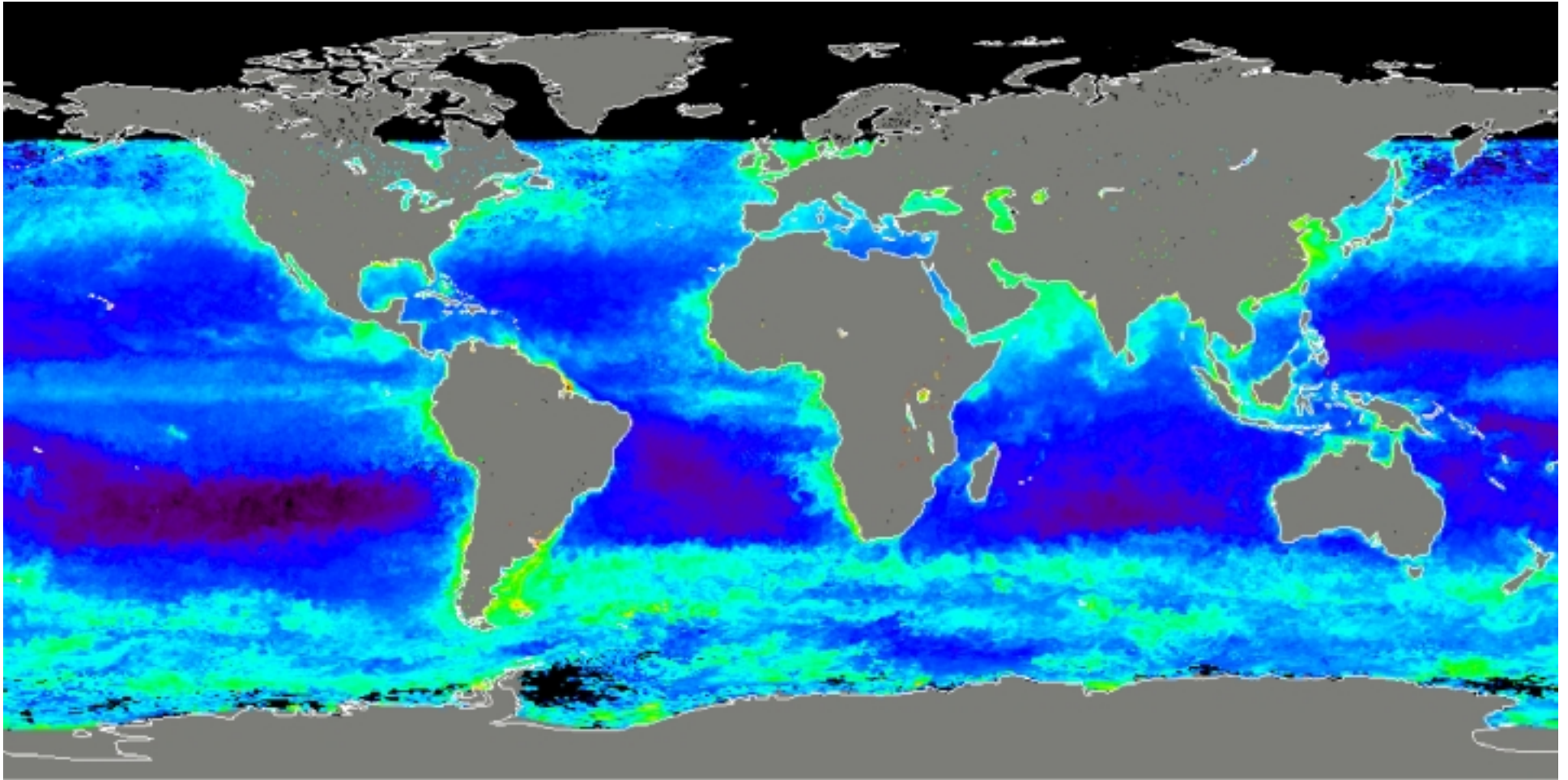
This is an empirical algorithm using the 443:551 and 488:551 band ratios whichever is greater.

- SeaWiFS algorithm      OC4.v4 (O’Reilly & al)

This is an empirical algorithm using the 443:555, 490:555 and 510:555 band ratios whichever is greater.



Chlor\_a\_2 December 2000

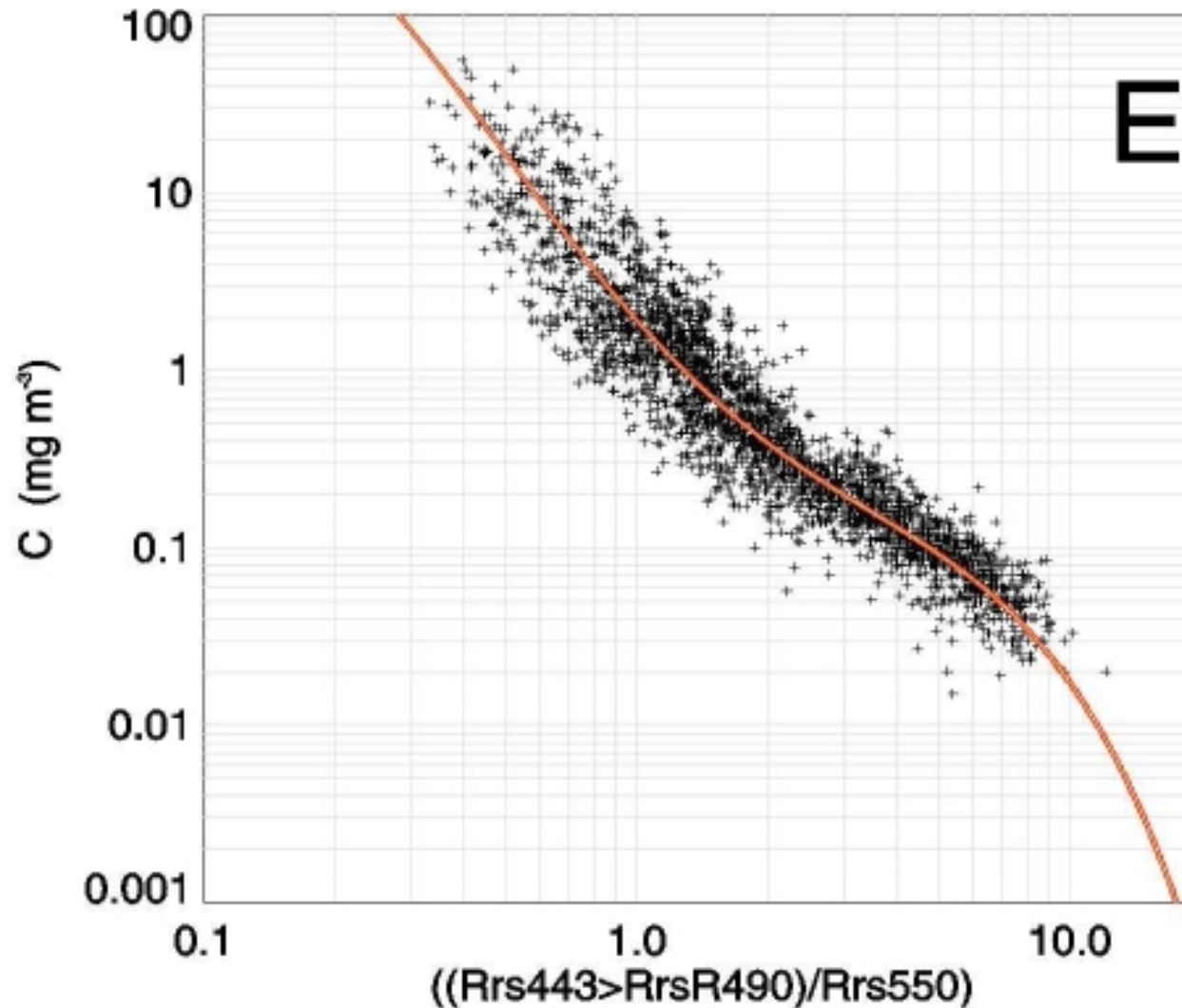


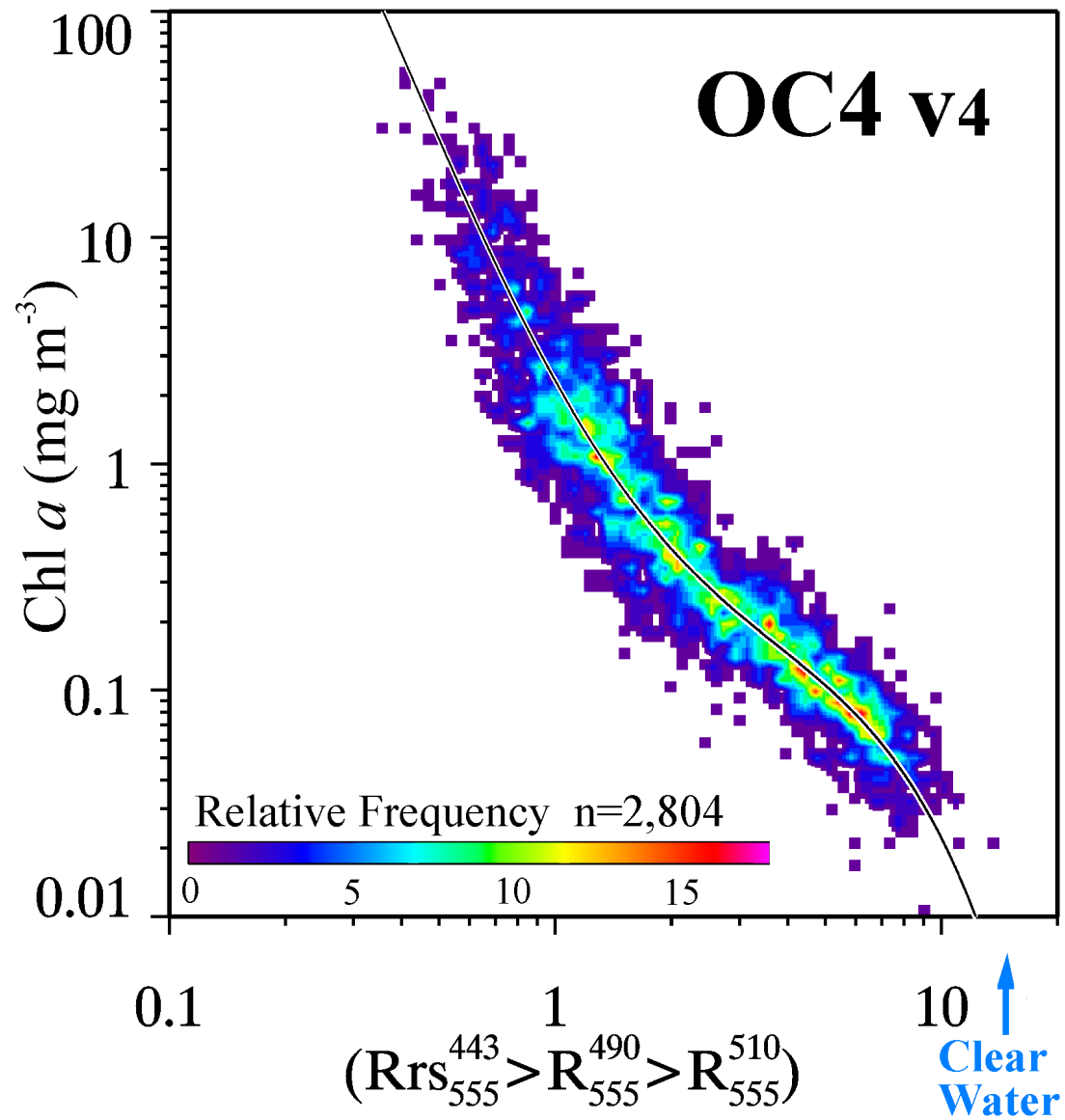
This “SeaWiFS compatible” algorithm is based on the same data set used to parameterize the SeaWiFS algorithm.



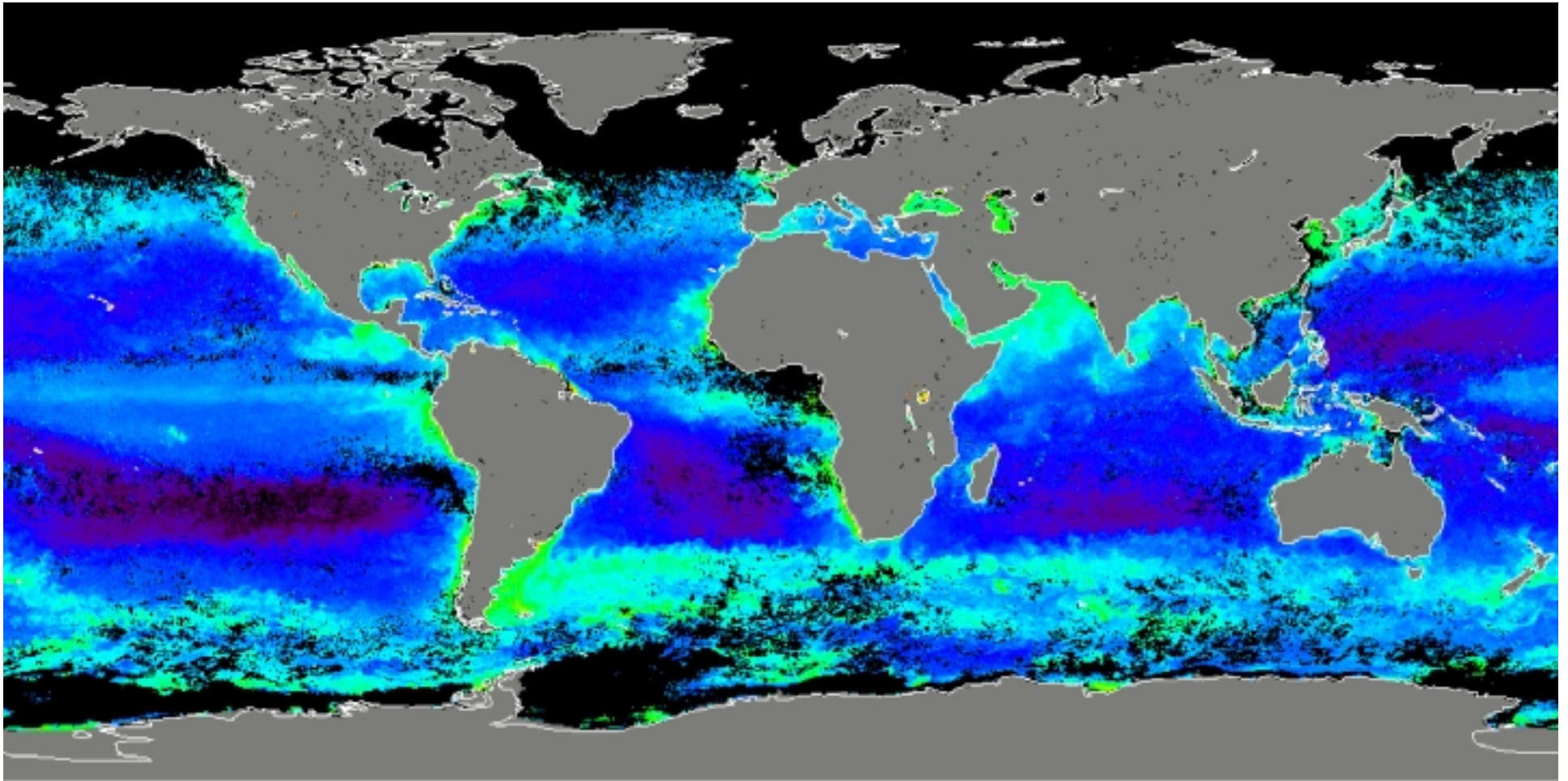
The Chlor\_a\_2 algorithm was proposed by the developers of the SeaWiFS OC4.v4 algorithm (O'Reilly et al. 2000).

It was called OC3M (3 band, M for MODIS).





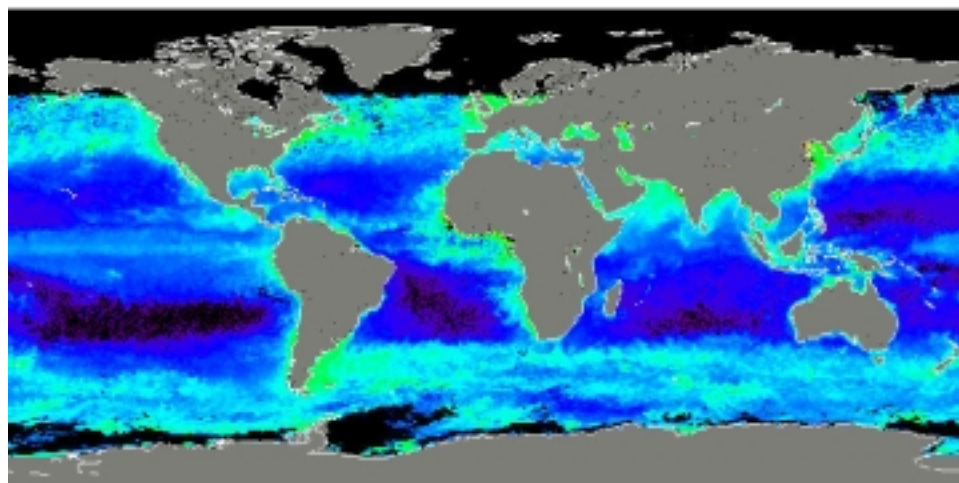
# SeaWiFS December 2000



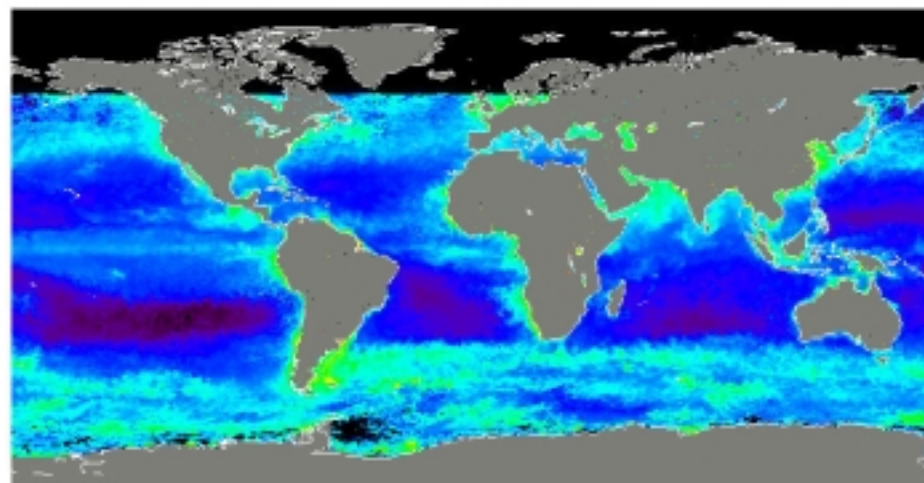


chlorophyll - DAAC

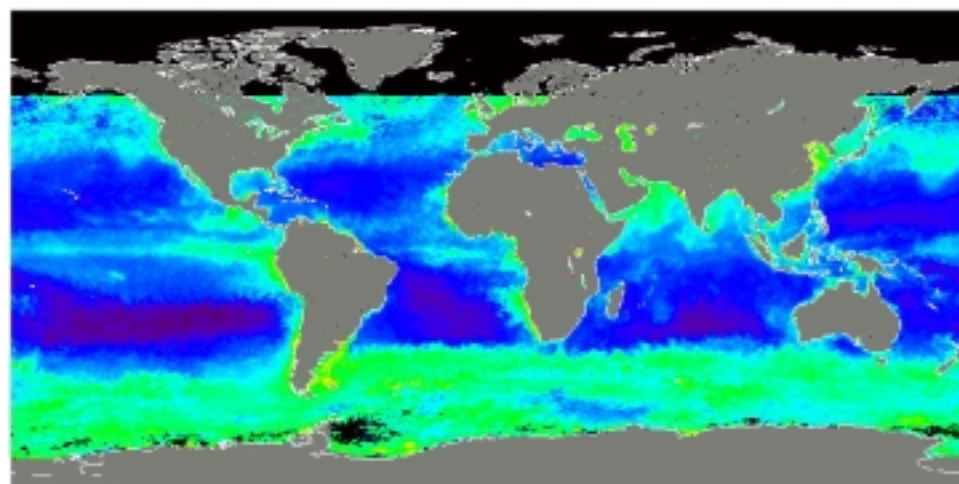
Chlor\_modis



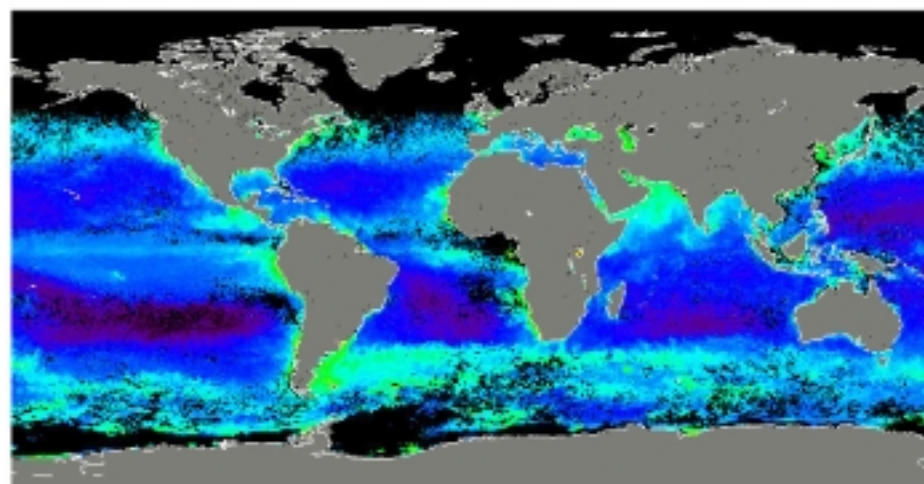
Chlor\_a2



Chlor\_a3



SeaWiFS



December 2000

Chlorophyll

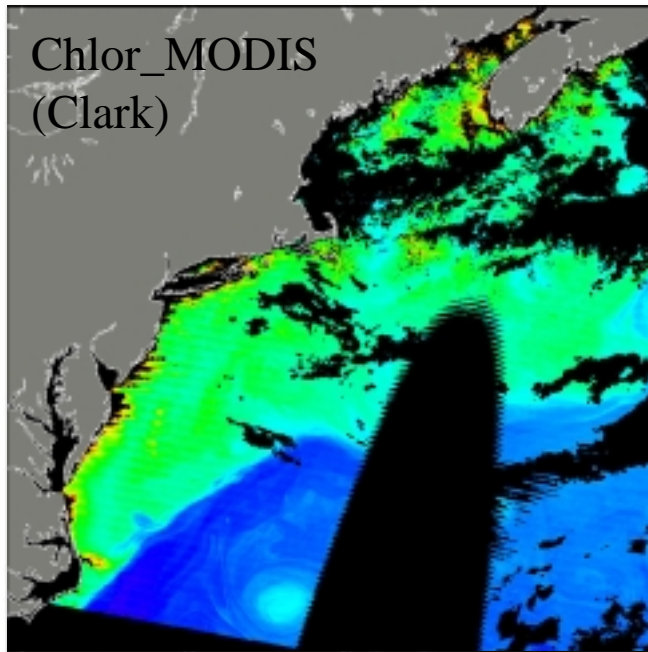
mg/m<sup>3</sup>



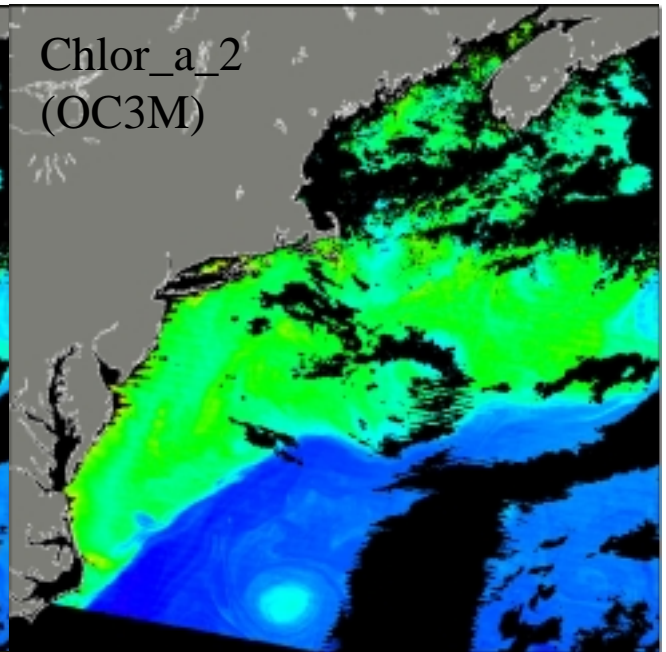
MODIS scene A2000.129.1545  
SeaWiFS scene S2000129165158

May 8, 2000

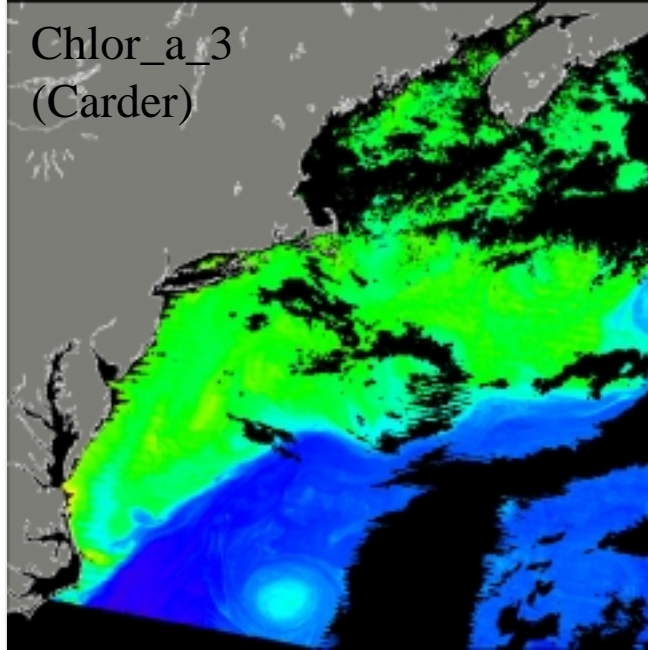
Chlor\_MODIS  
(Clark)



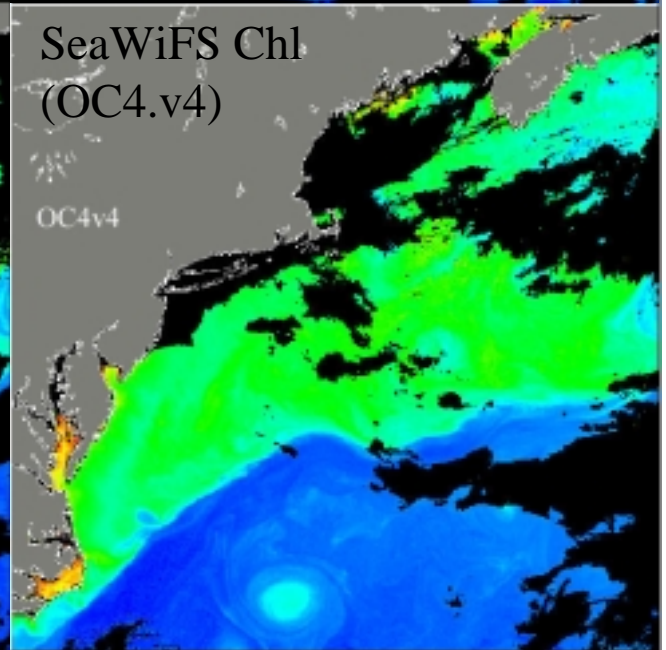
Chlor\_a\_2  
(OC3M)



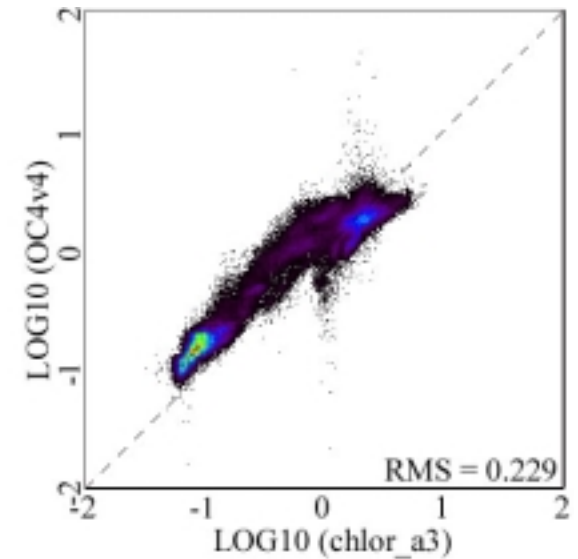
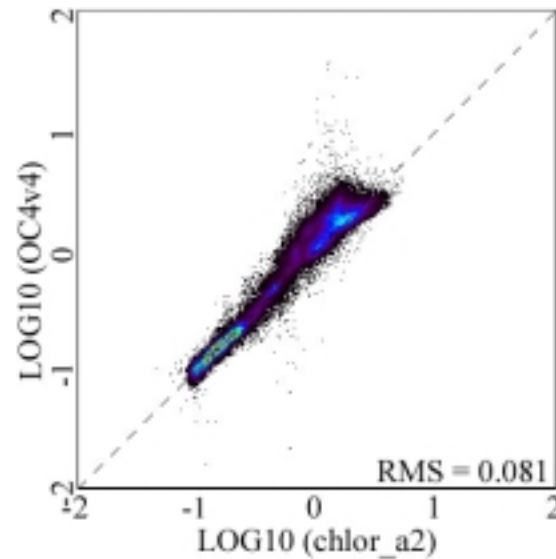
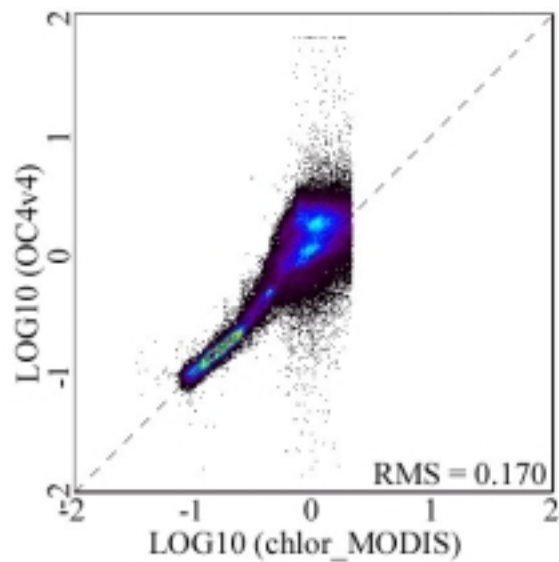
Chlor\_a\_3  
(Carder)



SeaWiFS Chl  
(OC4.v4)



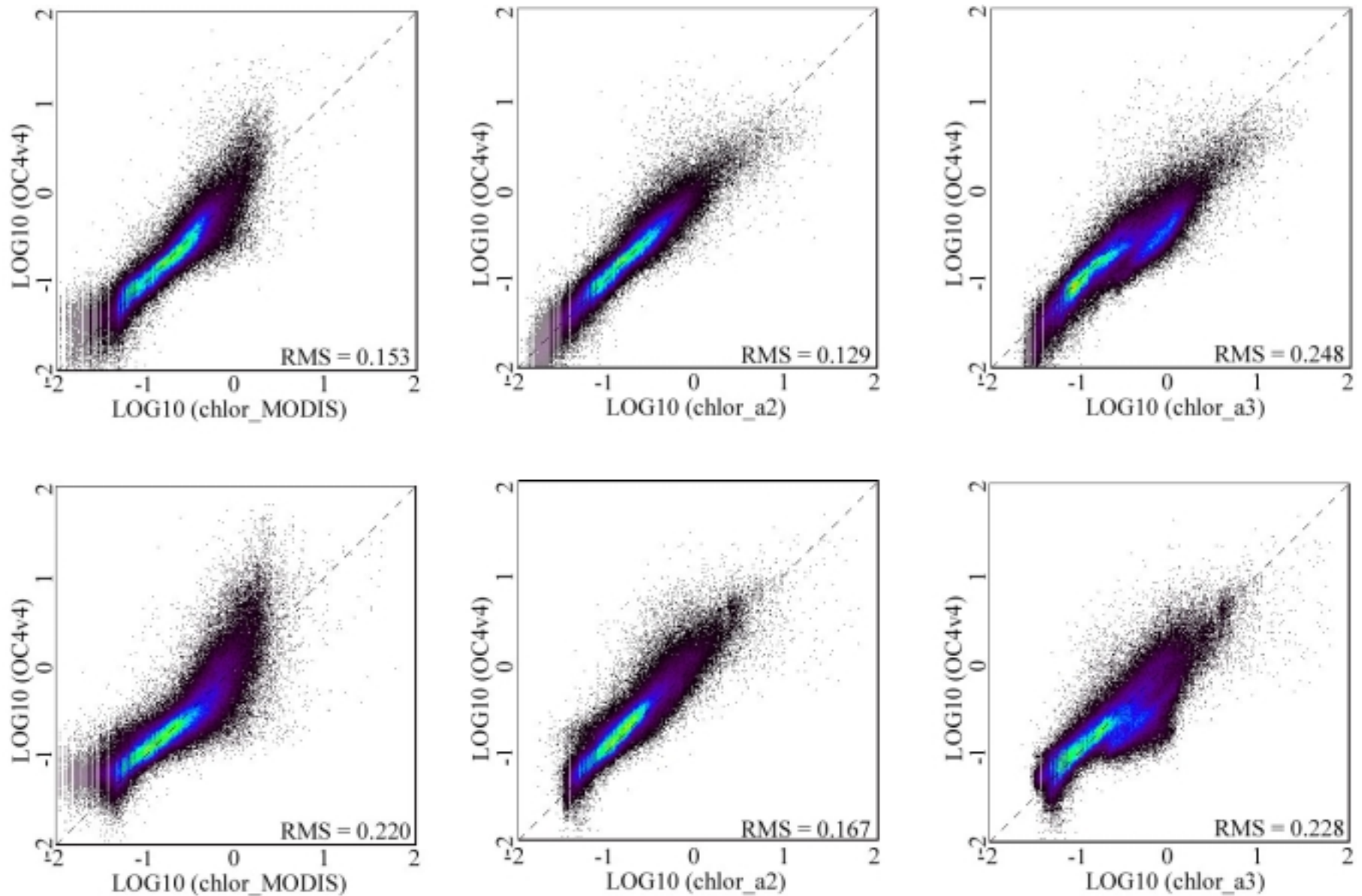
## SeaWiFS Chlorophyll



May 8, 2000. Full-resolution (1-km) scene off U.S. East Coast.

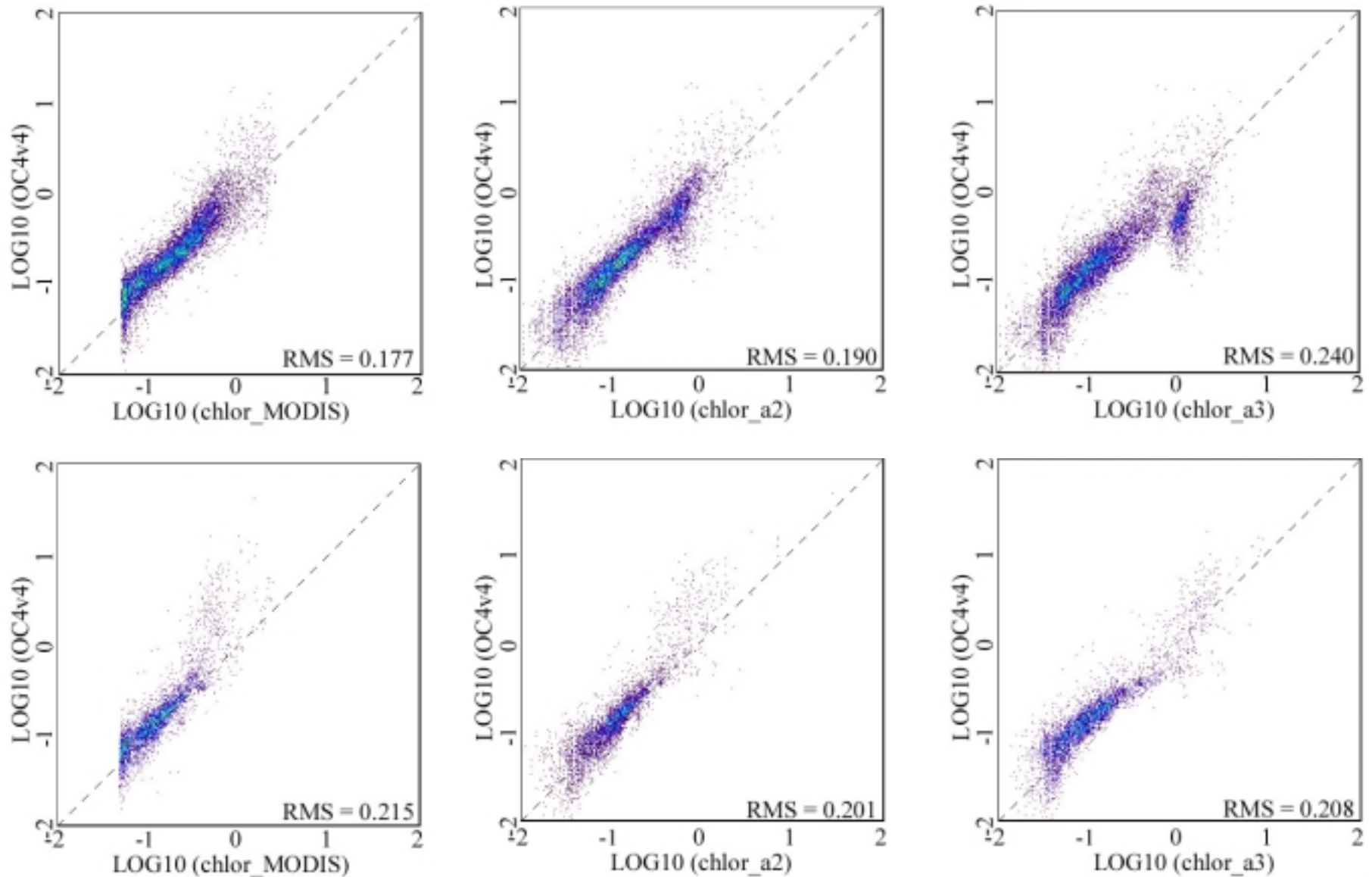


## SeaWiFS Chlorophyll



Top row: Global Dec. 2000. Bottom row: Global Aug. 2001.  
Both are 36-km products from the DAAC.

## SeaWiFS Chlorophyll



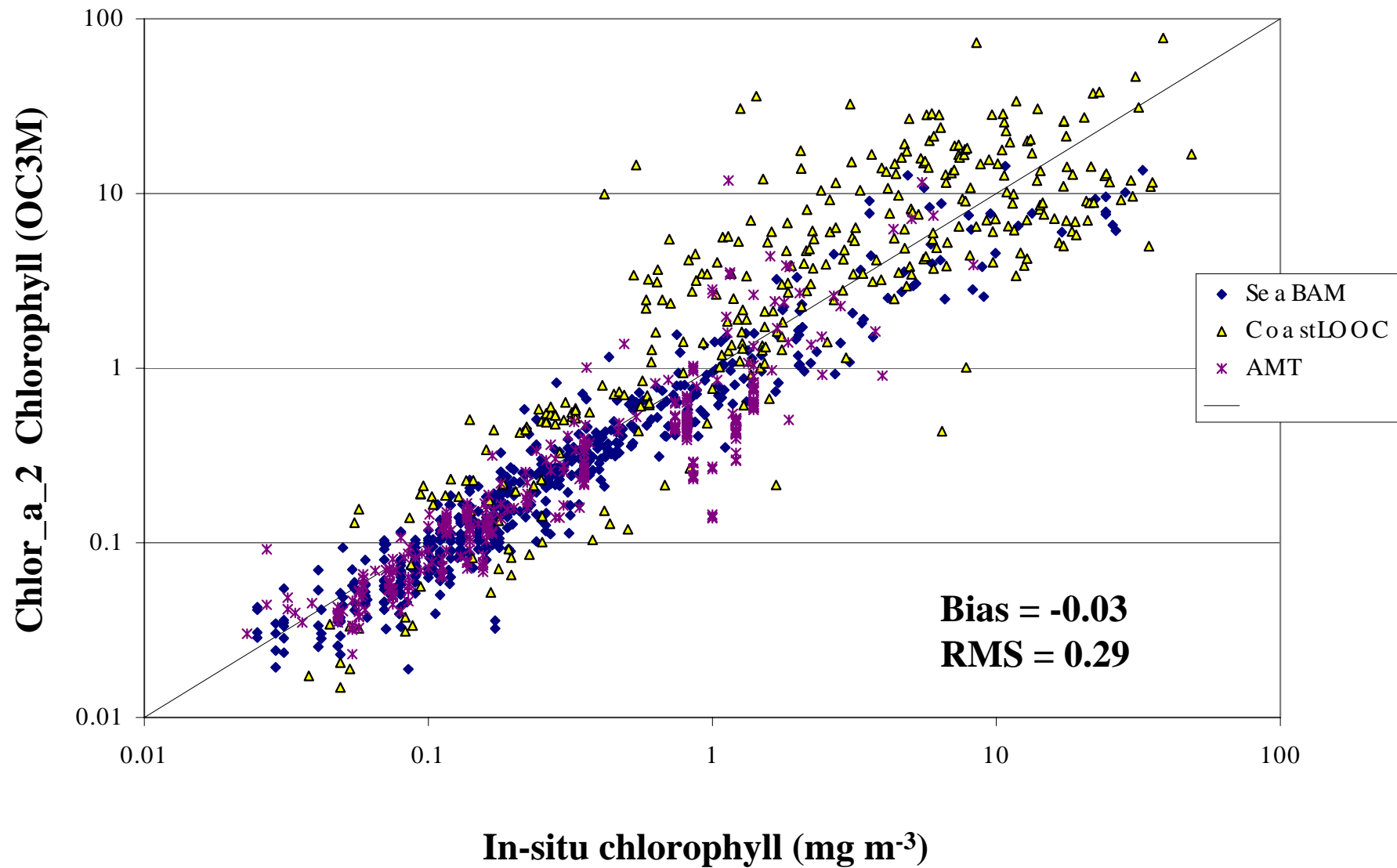
Top row: Dec. 4, 2000. Bottom row: June 10, 2001.

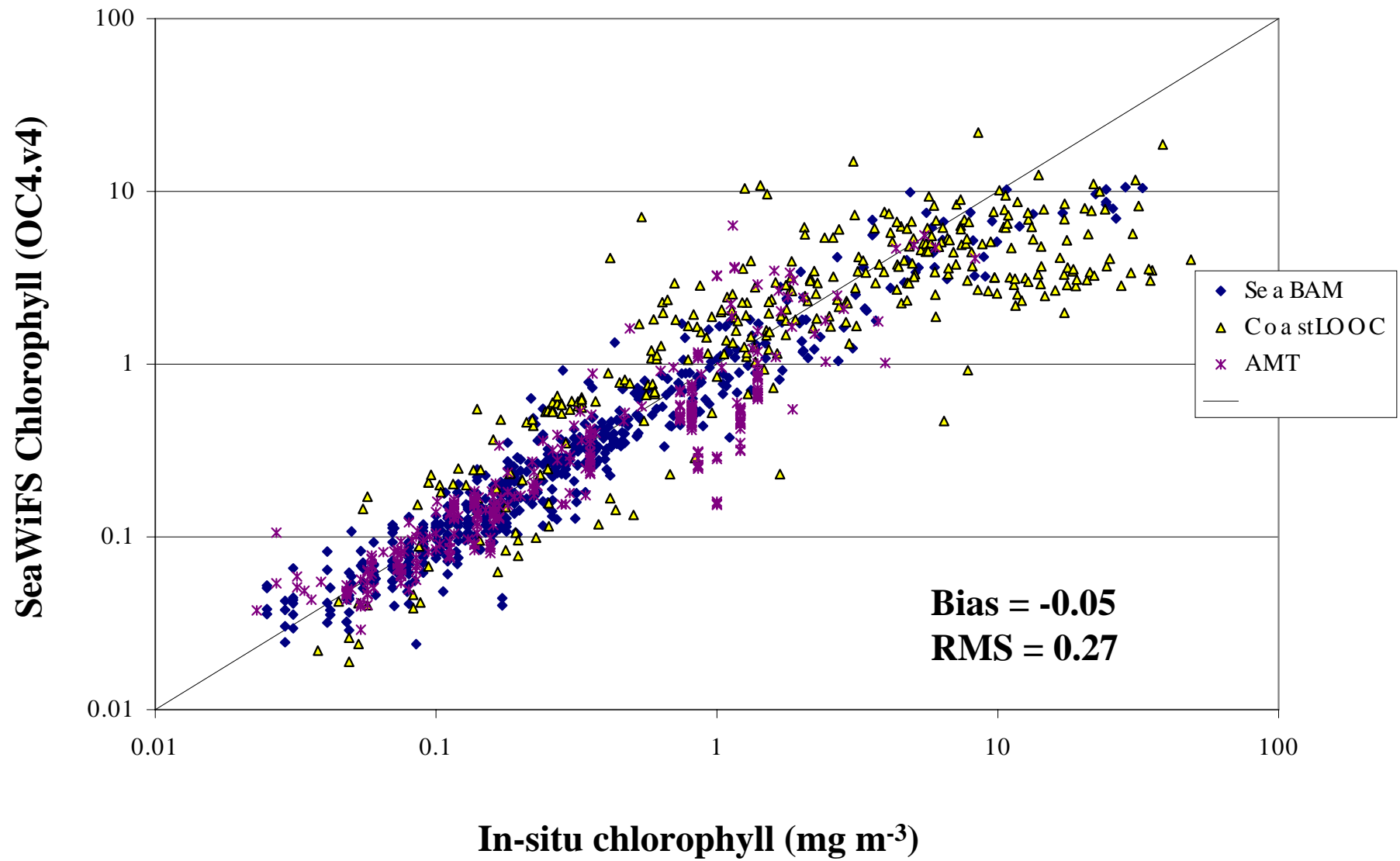
Both are global daily 36-km products.

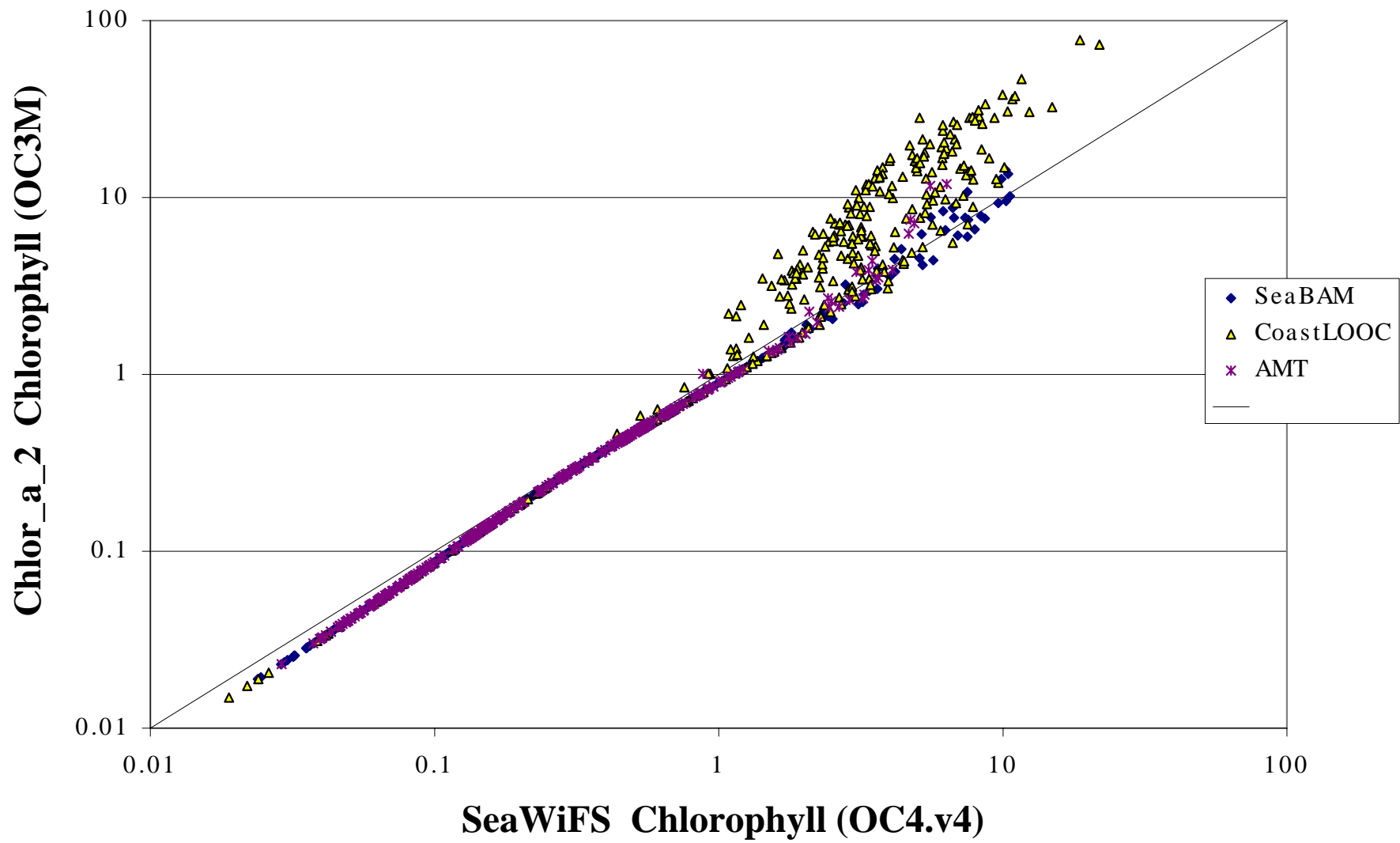
Our approach is to test algorithms using in-situ data

In-situ Data: We have combined three in-situ data sets of reflectance and chlorophyll data for a total of  $n = 1,229$  stations.

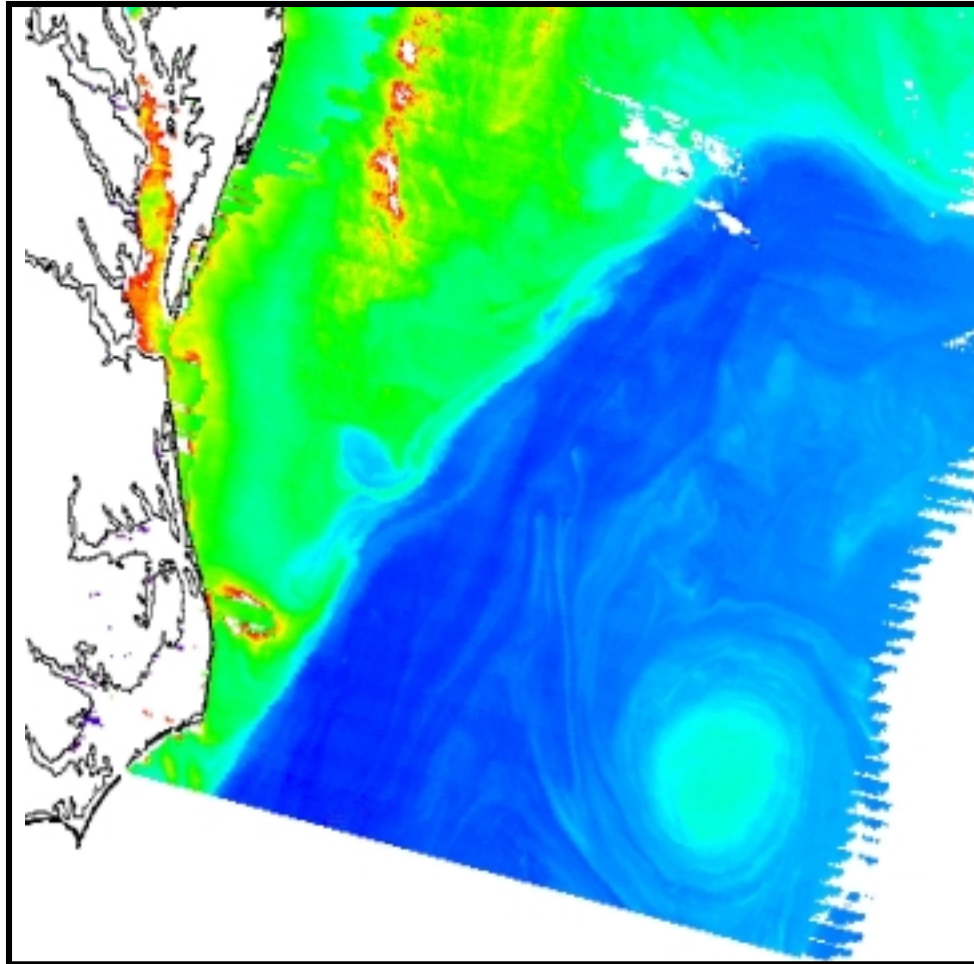
- Subset of the original SeaBAM data which had measurements at 443, 490, and 510 nm ( $n = 539$ )
- COASTLOOC data from European coastal waters ( $n = 324$ )
- AMT cruise data obtained from SeaBAS ( $n = 366$ )



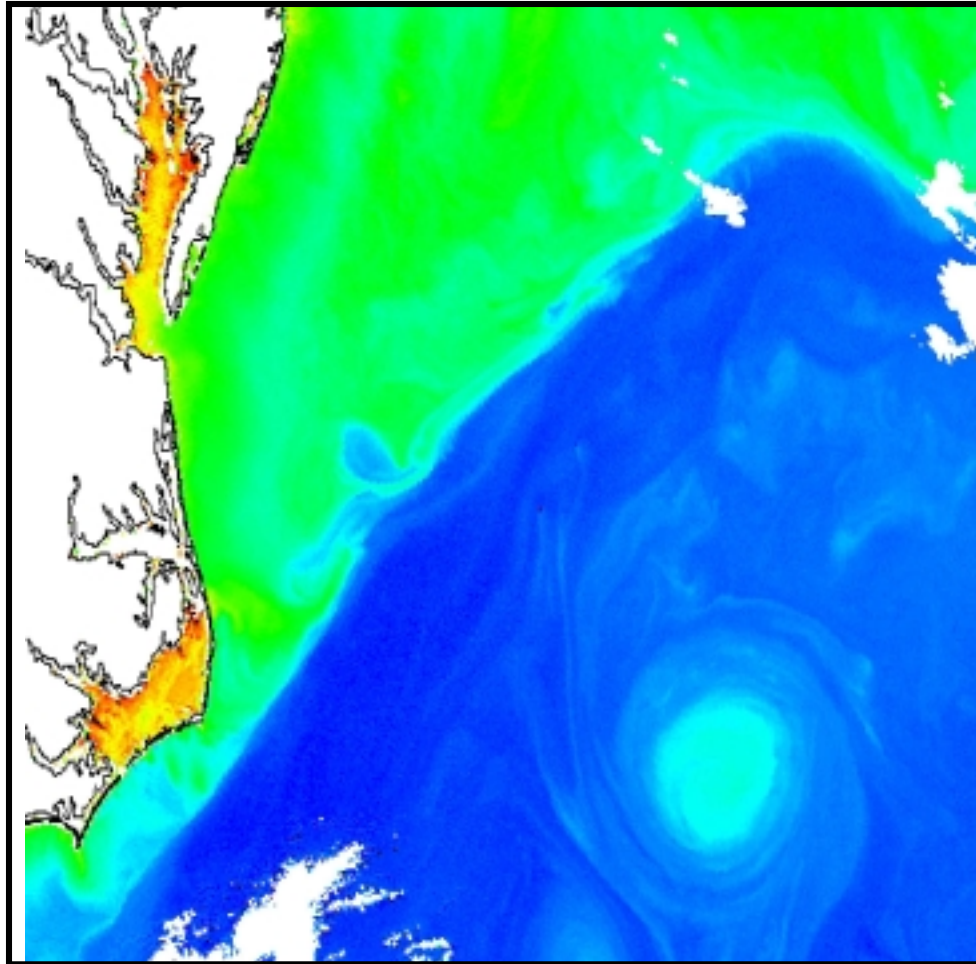




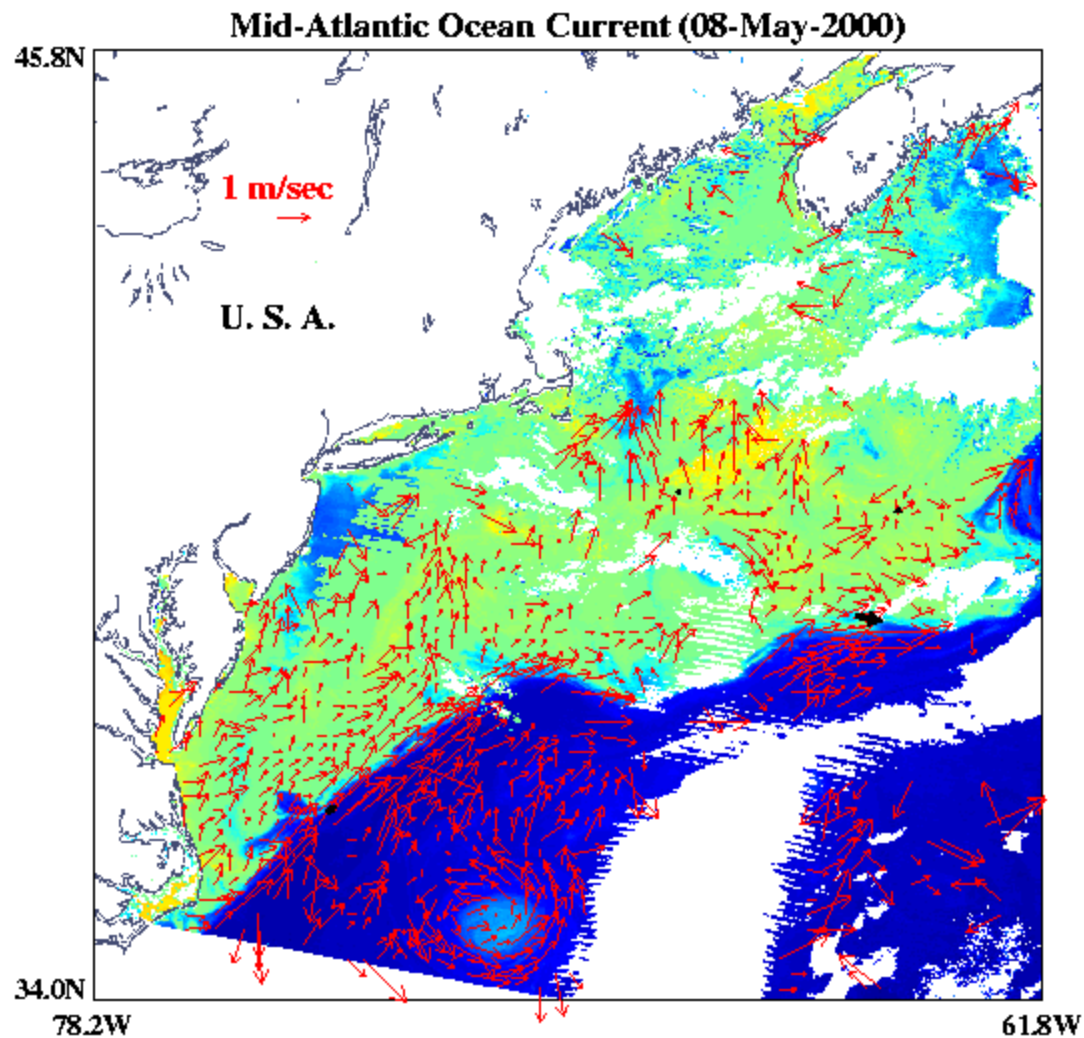




MODIS Chlorophyll: May 8, 2000 10:45 am



SeaWiFS Chlorophyll: May 8, 2000 11:51 am



**“Ocean Surface Layer Drift Revealed by Satellite Data”**

Antony K. Liu, Yunhe Zhao, Wayne E. Esaias,  
Janet W. Campbell and Timothy S. Moore  
(in press, EOS Transactions Newsletter)

# CONCLUSIONS

- MODIS and SeaWiFS chlorophylls agree reasonably well. RMS  $\sim 0.2$  log units
- RMS  $\sim 0.3$  log units when comparing MODIS or SeaWiFS with in-situ chlorophyll measurements.
- The differences can be explained in terms of pigment packaging (Chlor\_a\_3), or surface layer drift (e.g. Liu et al. 2001).
- The Chlor\_a\_2 product is ready to be validated after the next reprocessing. By definition, if it is compatible with SeaWiFS, then it is valid.